ON THE FORMATION OF STALACTITES AND GYPSUM INCRUSTATIONS IN CAVES.

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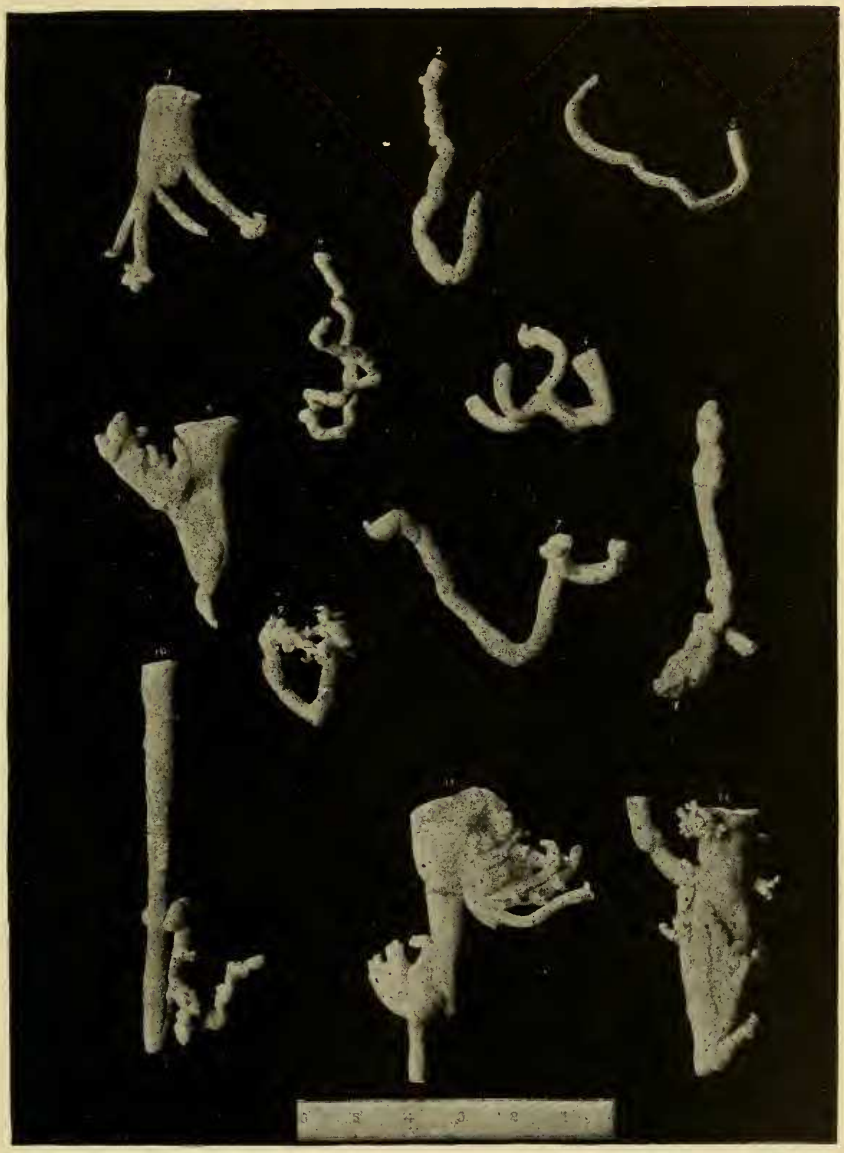
During the season of 1893 work in connection with the World's Columbian Exposition took the writer into a considerable number of the limestone caverns of the eastern United States and afforded him opportunity for observations regarding the methods of formation of the interesting deposits noted in the title. The results of these observations are given herewith, it having seemed to me that, while no new principle is involved, the subject as a whole has not received all the attention it deserves.

Stalactites.—The manner in which the carbonate of lime in the form known as stalactite and stalagmite is deposited is, in brief, as below: Water filtering through the roof of a limestone cavern, is, in virtue of the carbonic acid it contains, enabled to dissolve a small amount of the lime carbonate, which is again deposited when the excess of carbonic acid escapes either through relief from pressure or the evaporation of the water. Conditions favorable to either process are furnished by the water filtering through the roof and dripping slowly to the floor beneath. In cases where the water filters sufficiently slowly, or evapooration is correspondingly rapid, the deposit of lime carbonate from the roof takes at first the form of a ring around the outer portion of the drop, a natural consequence of the evaporation of a suspended drop of liquid, as may readily be shown by laboratory experiments. This process may go on until the ring becomes prolonged into an elongated cylinder, or tube, the diameter of which may not exceed five millimeters, though usually ranging from five to ten, and of all lengths up to 50 cm. In exceptional cases this length may be exceeded, but owing to the delicacy of the material, the stalactite usually breaks of its own weight and falls to the floor before a length of even 100 or 150 mm. is reached, to become imbedded in the stalagmitic material there forming. Lengths of even these dimensions are comparatively rare for the reason that the tube becomes shortly closed, either at its

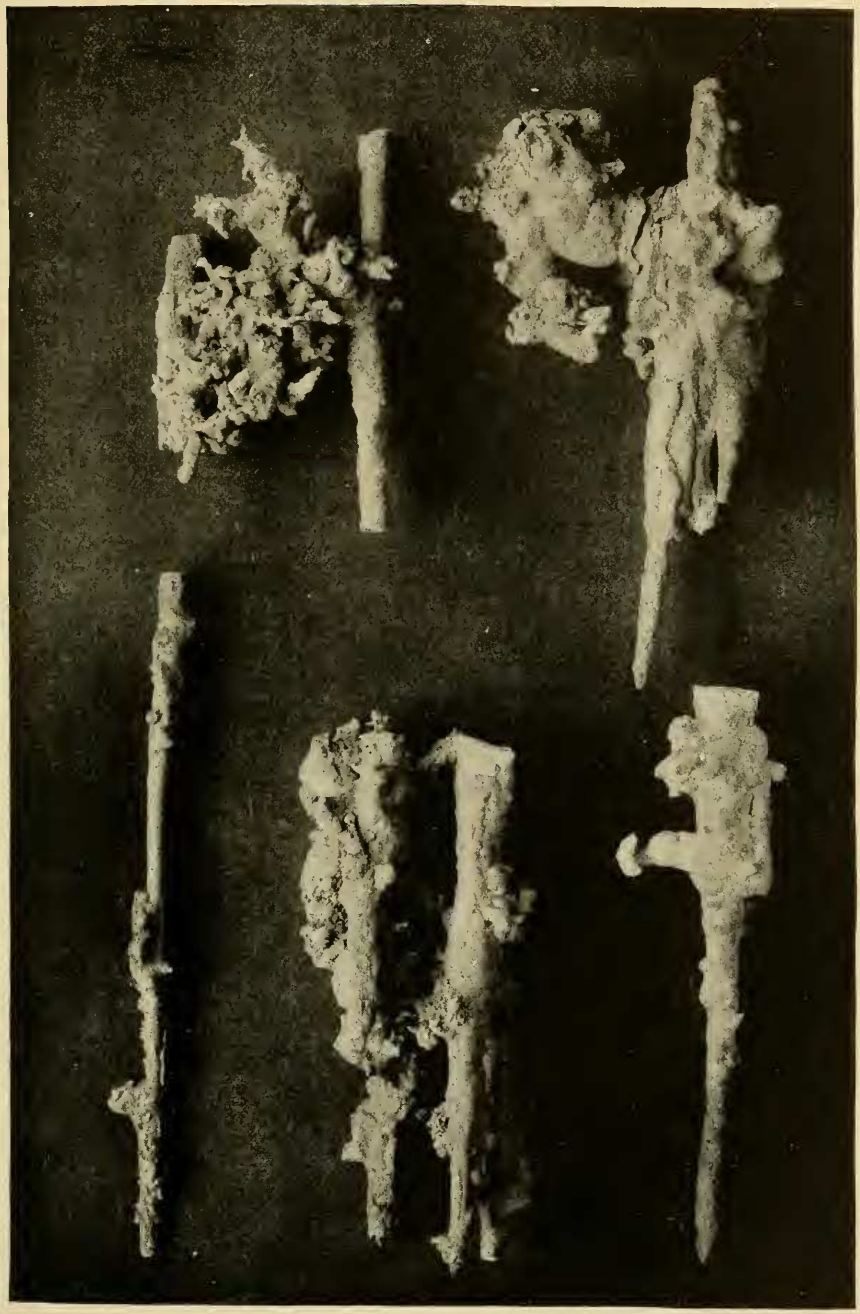
upper or lower end, usually the upper, and all growth from the extremity alone ceases, subsequent deposition being wholly exterior, and taking place in the form of concentric coatings of the carbonate on the outer surface and at the same time from the top. There is thus formed around the original tube a compact cylindrical mass, in its typical form constricted at point of attachment but thickening rapidly, and then tapering gradually into an elongated cone. The material of the stalactite is not always wholly carbonate of lime, but in some cases thin intervening coats of iron disulphide are met with; these are rarely more than a millimeter or so in thickness. Such forms have been found in the caverns of Luray, in Virginia. The presence of a magnesian carbonate in these deposits has not been detected in any amount. Through a crystallization which must be nearly contemporaneous with deposition, or at least while the stalactite is still saturated with the carbonated waters, the mass of the material undergoes an arrangement which is sometimes distinctly fibrous (aragonite), the fibers radiating from the center outward, and not infrequently being curved downward —that is, curved in such a manner that when the stalactite is broken across it shows a concave and convex fracture, the concavity being uppermost—toward the top of the stalactite. In other cases the structure is granular throughout, through the development of calcite rhombs. In the stalactites from Weyer's Cave, Shendun, Virginia, the entire center is sometimes occupied by large (10 mm.) rhombs of clear calcite, from which radiate horizontally elongated forms of the same mineral. It is safe to assume that such crystallizations are wholly secondary.

It is a natural consequence of their method of deposition that stalactites of the type described above are as a rule nearly straight, and hang approximately perpendicularly from the roof. Exceptions to this rule will be noted below.

In the Wyandotte Cave, and to a less extent in some others, a peculiar vermiform stalactite is found which is quite at variance with those described above. They occur in clusters or groups both on the walls and ceiling and are remarkable for their peculiar fantastic twistings and turnings, which in extreme cases are almost Medusa-like. Their appearance can best be understood by reference to Pl. I, the scale being in inches. This shows a number of detached stalactites both simple and branching. The point of attachment is uppermost in the figures, with but one exception. In order that there be no misunderstanding I have placed the numbers always at the broken end. It will be observed that the processes of deposition already described fail to satisfactorily account for these forms, in which the law of gravity seems to have been set at defiance. In fig. 2, it will be noticed, the stalactite after growing irregularly downward for about 4 inches turned upward and grew in this direction for half its length. No. 3 grew downward for an inch or so, and then in a nearly horizontal and upward direction for three or four inches. Number 4 is a singularly contorted



IRREGULAR STALACTITES, WYANDOTTE CAVE, INDIANA.



IRREGULAR STALACTITES, LURAY CAVES, PAGE COUNTY, VIRGINIA.